

REMARKS

Claims 1, 3-6 and 8-10 were examined and reported in the Office Action mailed April 20, 2005. In the Advisory Action, it is maintained that Claims 1, 3-6 and 8-10 are rejected. Claims 1 and 6 are amended. Claims 1, 3-6, 8-10 remain.

Applicants request reconsideration of the application in view of the following remarks.

I. 35 U.S.C. § 112, First Paragraph

A. It is asserted in the Office Action that claims 1, 3-6 and 8-10 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a semi-crystalline structure when boron (B) is present in the carbon shell, does not reasonably provide enablement for such a semi-crystalline structure for the other metal components. Applicant respectfully traverses the aforementioned rejection for the following reasons.

Regarding the semi-crystalline structure, it is well understood to an ordinary person skilled in the related art that a semi-crystalline structure can be obtained using other metal components based on the description for a semi-crystalline structure with boron and the references submitted on August 17, 2005, which describes a twisting structure or an expansion structure that indicate a semi-crystalline structure. Applicant previously asserted the following:

Applicant submits the reference *Adsorption and oxidation of K deposited on graphite*, Surface Science 364(1996) pages 253-265, which asserts such terms known in the art that teaches K belonging to Group 1A intercalates through graphite layers to expand the interlayer distance. Applicant further submits the reference *Synthesis and crystal structure of Al₃BC, the first boridecarbide of aluminum*, Journal of Alloys and Compound 252(1997), pages 98-102, that teaches the twisting structure obtained from carbon and B (refer to Fig. 2 of this reference). Moreover, Applicant submits the reference *Density-functional based tight-binding calculations on zinc-blender type BC₂N-crystals*, Diamond and Related Materials 7(1998), pages 1633-1638, that teaches several structures of graphite-like BC₂N, that are twisting structures.

Additionally, the semi-crystalline structure of the carbon shell of Applicant's claimed invention is realized by adding metals to an amorphous carbon and improves capacity and efficiency. Thus, it is expected from Table 1 that the active materials according to Examples 2 and 3 using Si and Ni, respectively, have a similar semi-crystalline structure shell to the active material according to Example 1 using boron even though a differential thermal analysis was not conducted for the active materials of Examples 2 and 3. This is because the capacities and efficiencies of the active materials according to Examples 1 to 3 are improved over those of Comparative Examples 1 to 4.

Regarding the assertion in the Advisory Action that the submission of the references is untimely, Applicant respectfully disagrees. Applicant has respectfully submitted the references to assist the Examiner in understanding the claimed subject matter. After reviewing the Office Action mailed on April 20, 2005, Applicant felt the references would be useful to the Examiner to understand the claimed subject matter and that, which is known to an ordinary person skilled in the art. In the April 20, 2005 Office Action, it is asserted that "*[a]pplicant submits that the Group 3A or 4A elements result in twisting of the graphite structure while the Group 1A and 2A elements result in expansion. However, the specification is silent on this effect on the carbon shell.*" Based on this assertion, Applicant believes the submission of the references was first necessitated. Therefore, Applicant respectfully asserts the submission of the references is timely.

Applicant notes that the relevant pages of the references were submitted in the previous response (and listed above).

Accordingly, withdrawal of the 35 U.S.C. §112, first paragraph rejection for claims 1, 3-6 and 8-10 are respectfully requested.

II. 35 U.S.C. § 103(a)

It is asserted in the Office Action that claims 1, 3-6 and 8-10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,027,833 issued to Ueda et al. ("Ueda") in view of either U.S. Patent No. 5,595,838 issued to Yamada et al. ("Yamada") or U.S. Patent No.

6,337,159 issued to Peled et al. ("Peled"), and in further view of U.S. Patent No. 5,972,537 issued to Mao et al. ("Mao"). Applicant respectively traverses the aforementioned rejection for the following reasons.

According to MPEP 2142

[t]o establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure. (In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)).

Applicant's amended claim 1 contains the limitations of

[a] negative active material for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.

Applicant's amended claim 6 contains the limitations of

[a] negative active material for a rechargeable lithium battery comprising: a core including secondary particles, the secondary particle being prepared by agglomerating at least one primary particle of a crystalline carbon, an amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the

group of consisting of a transition metal, a semi-metal, an alkali metal and an alkali earth metal, and the metal is an elemental metal.

Applicant respectfully asserts that the previous arguments are not cumulative. Applicant has submitted arguments to indicate the differences between the claimed subject matter and the cited references and to assist the understanding of the relevant technology. Applicant maintains that claims 1 and 6 limitations of “semi-crystalline” is not amorphous and not crystalline.

Applicant has previously submitted the references *Evolution of microtexture in furan resin-derived carbon with heat-treatment*, Carbon Vol. 33, No. 10, pages 1377-1381, 1995, and *Electrochemical intercalation of lithium into graphitized carbons*, Solid State Ionics 80(1995), pages 291-298 to support the above-mentioned assertion and to assist in the understanding of the art. Applicant previously noted that the turbostratic structure in the reference paper indicates “semi-crystalline” and is middle stage during the conversion from amorphous carbon to crystalline carbon. Additionally, Applicant previously noted that the original specification discloses the carbon shell is neither crystalline nor amorphous on page 6, lines 11 to 17.

Ueda discloses a non-aqueous electrolyte secondary cell having a core made of crystalline graphite (carbon) structure. Ueda also discloses that a “low crystallinity or amorphous carbon layer 312 at least partially covering the core 311....” (Ueda, column 8, lines 9-13). The carbon shell disclosed in Ueda is *not made of an elemental metal*. Unlike the carbon shell of Applicant’s claimed invention, the carbon shell disclosed in Ueda has a lower crystallinity, i.e. *amorphous carbon*.

Ueda simply does not disclose, teach or suggest a

the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.

Yamada discloses a non-aqueous secondary battery arranged having “graphite-like planes [] arranged and stacked in an onion-like shell micro-texture ...” (Yamada, column 3, lines 44-49). Yamada further discloses that the carbon composite electrode includes a crystalline carbon core, a metal film coating the surface of the crystalline carbon core and a carbon layer deposited on the whole surface of the metal film. Yamada does not disclose, teach or suggest

[a] negative active material for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.

Peled discloses a non-aqueous electrochemical cell arranged having a synthetic passivating layer (SEI) being made of “ MACO_3 , M_2CO_3 , alkali semi-carbonates, MAO, M_2O , MAS, M_2S and alkali-and alkaline-earth metal salts of surface carboxylic groups (M=alkali metal, MA=alkaline earth metal). Distinguishable, Applicant’s claimed invention has a carbon shell in the form of an elemental metal, whereas Peled discloses *alkali semi-carbonates, alkali and alkaline earth metal salts, i.e. metal compounds*. Applicant’s claims 1 and 6 contain the limitation “a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.” Peled, however, discloses the SEI (synthetic passivating layer) of is made of “ MACO_3 , M_2CO_3 , alkali semi-carbonates, MAO, M_2O , MAS, M_2S and alkali-and alkaline-earth metal salts of surface carboxylic groups (M=alkali metal, MA=alkaline earth metal)”. In addition, the SEI is formed by preferably bonding the SEI to the surface groups of the carbon particles after the surface groups are formed on the carbon particles.

Further, Peled does not disclose, teach or suggest a

[a] negative active material for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at

700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.

Mao discloses a method of fabricating a carbon material for use as an electrode in an electrochemical cell. Mao discloses that the “carbon materials are substantially amorphous [and they can also be] partially or completely crystalline or amorphous but possessing crystalline inclusions.” (Mao, column 3, lines 6-10). Mao, however, does not teach, disclose or suggest that carbon has a semi-crystalline structure. Further, Mao does not teach, disclose or suggest

[a] negative active material having a double layer structure for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal.

Therefore, even if the teachings of Ueda, Yamada, Peled and Mao were combined, the resulting invention would still not teach, disclose or suggest

[a] negative active material for a rechargeable lithium battery comprising: a core including crystalline carbon, amorphous carbon or a mixture thereof; and a carbon shell formed around the core, the carbon shell including carbon derived from amorphous carbon and having a semi-crystalline structure and at least one shoulder at 700°C or more without a peak at less than 700°C in differential thermal analysis, and the carbon shell including a metal selected from the group consisting of a transition metal, an alkali metal and an earth metal, and the metal is an elemental metal

since neither Ueda, Yamada, Peled, Mao, and therefore, nor the combination of the four, disclose, teach or suggest all of these limitations. Thus, Applicant’s amended claims 1 and 6 are not obvious over Ueda in view of either Yamada or Peled, and further in view of Mao since a

prima facie case of obviousness has not been met under MPEP 2142. Additionally, the claims that directly or indirectly depend from Applicant's amended claims 1 and 6, namely claims 2, and 3-5, and 8-10, respectively, are also not obvious over Ueda in view of either Yamada or Peled, and further in view of Mao for the above same reason.

Accordingly, withdrawal of the 35 U.S.C. § 103(a) rejections for claims 1, 3-6 and 8-10 are respectfully requested.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending, namely 1, 3-6, and 8-10, patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

PETITION FOR EXTENSION OF TIME

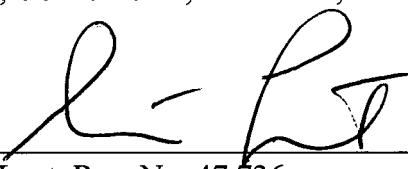
Per 37 C.F.R. 1.136(a), Applicants for the above-identified application respectfully Petition the Commissioner for a three (3) month extension of time, extending the period for response to October 20, 2005, from the Final Office Action dated April 20, 2005. The petition filing fee of \$1020.00 and an Amendment and Response to Office Action are attached.

If it should be determined that a longer extension of time is required to prevent this application from being abandoned, please charge any additional fees to Deposit Account No. 02-2666. A copy of the Fee Transmittal is enclosed for deposit account charging purposes.

Respectfully submitted,

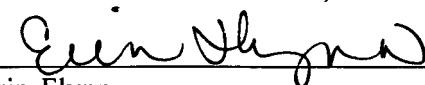
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Dated: October 20, 2005

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I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail with sufficient postage in an envelope addressed to: Mail Stop AF, Commissioner for Patents, P. O. Box 1450, Alexandria, Virginia 22313-1450 on October 20, 2005.


Erin Flynn